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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
KRONENTHAL, CRAIG W	
ART UNIT	**PAPER NUMBER**
2623	

DATE MAILED: 08/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/942,004	FLORENT ET AL.	
	Examiner	Art Unit	
	Craig W. Kronenthal	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *14 February 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6 and 9-14* is/are rejected.

7)☒ Claim(s) *7 and 8* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 August 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment filed February 14, 2005, has been entered and made of record.

2. The claim objections have been withdrawn in view of this amendment.

Response to Arguments

3. Applicant's arguments with respect to claim 1 have been fully considered but they are not persuasive. Applicant argues in essence that Corby does not disclose using at least one past image to calculate prediction data used for improving guide-wire extraction in a present image. The examiner disagrees and indicates that Corby discloses extracting a first set of pixels (corresponding to applicant's (G_{t-1})) from a past image to estimate a second set of pixels (corresponding to applicant's silhouette) for a subsequent image (col. 9 lines 56-60). Furthermore, Corby discloses the utilization of the second set of pixels to determine constraints for the detection of a final string of points in the present time (col. 9 lines 61-63). The TSIA (Figure 1, item 114) uses past images (a current image and a number of previous images) to predict a silhouette (2D guide wire model) (col. 4 lines 36-42). The TSIA (114) then controls the modulator (Figure 1, item 108) to estimate a search zone and direction based on its prediction (col. 4 lines 42-46). Finally, the TSIA (114) again performs peak detection (Figure 3, 300)

and 2D model building (Figure 6, 600) on the image at a present time to obtain a final string of points (col. 4 lines 64-67).

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-6 and 9-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Corby, Jr. (P.N. 5,253,169). (hereinafter Corby)

Regarding Claim 1: Corby discloses an image processing method for extracting a threadlike structure represented in an image, comprising steps of:

- Executing a phase of acquisition of a sequence of images, including an image of a present instant (t) in which the threadlike structure is to be extracted and an image of a past instant (t-1) in which the threadlike structure is detected as a string of points [A detection screen (Fig. 1, 104) captures frames of a threadlike structure, specifically the outline of a catheter (col. 3 lines 37-46), at multiple instances of time (col. 3 lines 29-31 and col. 4 lines 31-36).],

- Executing a phase of prediction of a silhouette of the threadlike structure estimated form said detected string of points of the image of the past instant [The raw image input to the TSIA is peak detected (Figure 3, item 300) to create points of a past image (col. 4 line 67- col. 5 line 2). These points are then connected together to form a string of points (2D model of the catheter guide wire) by the two-dimensional model creation module (Figure 6, item 600) (col. 5 lines 2-6). The 2D models of the current image (corresponding to the image of the past instant) and previous images (corresponding to images prior to the past instant) are used by the TSIA to predict a silhouette (image of the catheter in the next frame) (col. 4 lines 39-42).],
- Executing a phase of pursuit for extracting a final string of points representing the threadlike structure in the image of the present instant t, including estimating a constraint CZt, defined as a search zone, and θ, defined as the direction of said silhouette, said constraints utilized for performing said extraction [The TSIA uses the predicted silhouette (predicted image of the catheter in the next frame) to adjust the modulator (Figure 1, item 108) (col. 4 lines 40-46). The modulator (108) is adapted based on estimates of a desired search zone (extent and shape) and direction (col. 3 lines 57-66). Therefore, the modulator (108) utilizes the constraints, estimated from the prediction, to perform extraction in the present time. The TSIA repeats the processes of peak detection (300) and 2D model building (600) for each frame, thereby extracting a final string of points (2D

guide wire model) representing the catheter in the present time (col. 4 lines 36-39).].

Regarding Claim 2: Corby discloses the method of claim 1, wherein in the prediction phase, the silhouette is formed of the string of points detected in the image of the past instant (t-1). The digitizer and frame store (Fig. 1, 112) digitizes each frame, including that of a past instant (t-1), which is then sent to the TSIA (Fig. 1, 114) (col. 4 lines 31-39). The TSIA executes a peak finding module (Fig. 3, 300) that inputs a digitized image of the past instant (t-1) and outputs a binary image containing guide wire pixels, which are connected by the 2D model creation module (Fig. 6, 600) to detect a string of pixels in the past image (t-1) forming a predicted silhouette of the present image (col. 4 line 64 - col. 5 line 6).

Regarding Claim 4: Corby discloses the method of claim 1, wherein within the step of executing the pursuit phase, the estimation of constraints requires estimation of the SearchZone in the image of the present instant (t) around the silhouette for a constrained extraction of the final string of points in said SearchZone [The TSIA uses the predicted silhouette (predicted image of the catheter in the next frame) to adjust the modulator (Figure 1, item 108) (col. 4 lines 40-46). The modulator (108) is adapted based on estimates of a desired search zone (extent and shape) (col. 3 lines 57-66). Therefore, the modulator (108) utilizes the search zone, estimated from the prediction, to constrain extraction in the present time.].

Regarding Claim 5: Corby discloses the method of claim 4, wherein the SearchZone is a Canal-Shaped Zone, and may be referred to interchangeably as Canal Zone or SearchZone, and is centered on said silhouette [The modulator (108) consists of vertical strips (Figure 2a, item 112) that are adjusted to variable heights thereby forming a canal shaped region centered on the silhouette (col. 3 lines 57 – col. 4 line 20).].

Regarding Claim 6: Corby discloses the method of claim 4, wherein the steps of estimation of constraints comprises the estimation of an interval of directions associated to the points of the Search-Zone [The modulator (108) is adjusted based on direction, which is an interval of directions (direction relative to the x-ray point source) (col. 3 lines 60-66).].

Regarding Claim 9: Corby discloses the method of claim 1, further comprising, in the pursuit phase, steps of tip evaluation for determining whether the tip of the extracted string of points is correctly located for representing the threadlike structure in the image of the present instant (col. 9 lines 4-10). The temporal sequence image analyzer (TSIA) (Fig. 1, 114), which houses both the prediction phase and pursuit phase, locates the tip of the catheter and sends a signal to the modulator indicating the position. It is understood that the TSIA (114) would not send this signal if the catheter could not be located and therefore the system would switch to a full field of view (col. 9 lines 19-22).

Regarding Claim 10: Corby discloses the method of claim 9, further comprising in the pursuit phase, steps of shape correlation for estimating the correct location of a final tip for the final string of points representing the threadlike structure (col. 3 lines 60-66). The modulator (Fig. 1, 108), although separate from the TSIA (114), is considered along with the TSIA (Fig. 1, 114) as part of the pursuit phase responsible for performing the step of shape correlation. The shape of the aperture is correlated with the silhouette estimated by the TSIA (114) by varying the heights of the strips (Figure 2a, item 112) (col. 4 lines 1-20).

Regarding Claim 11: Corby discloses the method of claim 1, having a loop (4) between the pursuit phase and the prediction phase for improving the detection of the silhouette and the extraction of the string of points for representing the threadlike structure in the image of the present instant (t) (col. 5 lines 55-58). The loop (Fig. 6, 630) returns the optimal guide wire path outputted by curvature minimization module (Fig. 6, 636) belonging to the pursuit phase to the tree to the tree building module (Fig. 6, 632) belonging to the prediction phase.

Regarding Claim 12: Corby discloses a system comprising a suitably programmed computer or a special purpose processor having circuit means, which are arranged to process image data according to the method as claimed in claim 1 (col. 4 lines 36-39). Corby discloses that the TSIA (Fig. 1, 114) is a computer programmed to perform the method of claim 1 as previously described.

Regarding Claim 13: Corby discloses a medical examination imaging apparatus having means for acquiring medical digital image data and having a system having access to said medical digital image data according to claim 12, and having display means for displaying the medical digital images and the processed medical digital images (col. 3 lines 50-53). The medical imaging apparatus (Fig. 1) utilizes a detection screen (Fig. 1, 104) as an acquisition means for obtaining x-ray images and a video monitor (Fig. 1, 122) for displaying the output.

Regarding Claim 14: Corby discloses a computer program product comprising a set of instructions for carrying out a method as claimed in claim 1 (col. 4 lines 36-39). The TSIA (Fig.1, 114), which embodies both the prediction and pursuit phases is a computer programmed equipped with the necessary steps (Figs. 3 and 6) to carry out the method described in claim 1.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Corby in view of Sun et al. (PN 6,480615). (hereinafter Sun)

Regarding Claim 3: Corby discloses the method of claim 1, wherein:

- The acquisition phase comprises a first image of a first past instant (t-2) and a second subsequent image of a second past instant (t-1), in which the threadlike structure is detected as respective first and second strings of points [A detection screen (Fig. 1, 104) captures frames of a threadlike structure, for example a catheter, at multiple instances in time (col. 4 lines 31-32). The digitizer and frame store (Fig. 1, 112) receives the frames and converts the images into discrete points (col. 4 lines 32-36).].

Corby does not disclose the calculation of a translation value or a speed of translation. However, Sun discloses motion estimation within a sequence of images wherein:

- The step of executing the prediction phase comprises a calculation of a translation value and a speed of translation between the first and second strings of points, wherein the calculation of the translation value occurs between the second past instant (t-1) and the present instant (t), and wherein the translation value is utilized for estimating the location of the silhouette in the image of the present instant (t) [The motion estimation subsystem (Figure 6, item 17) calculates a translation value and translation speed (motion vector) between a first string of points (initial frame) and a second string of points (a subsequent frame) (col. 15 lines 51-53). The motion vectors are calculated by determining

differences in an object's position between a prior image and a subsequent/current image (col. 19 lines 39-43). The position difference reads on the translation value and the motion vector, which is well known in the art to indicate both direction and speed, reads on the translation speed. Furthermore, the motion vector is calculated in step 49, which comes after inputting an image at a past instance (t-1) done in step 37 (Figure 7) but before inputting an image at a present instance (t) done in step 37 of the next loop. Still furthermore, Sun teaches utilizing the translation value (motion vector) for estimating the location of an object (col. 15 lines 43-58).].

It would have been obvious to one of ordinary skill in the art to modify the TSIA (Figure 1, item 114) of Corby to utilize motion vectors to predict the location of a desired object as taught by Sun. Corby discloses the prediction of a silhouette, but does not explicitly disclose the use of motion vectors to make its prediction. Corby suggests the use of motion vectors when mentioning the use of an estimated offset representing movement between frames (col. 9 lines 8-10).

Allowable Subject Matter

8. Claims 7 and 8 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Craig W. Kronenthal whose telephone number is (571) 272-7422. The examiner can normally be reached on 8:00 am - 5:00 pm / Mon. - Fri..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (571) 272-7414. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

8/10/05
CWK

JINGGE WU
PRIMARY EXAMINER